Electrostatic Containerless Technology for Thermophysical Property Measurements of Molten Materials

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ABSTRACT

Capabilities of the High Temperature Electrostatic Levitator (HTESL) for thermophysical property measurement of molten materials will be summarized. To isolate the molten materials from container walls the technology utilizes electrostatic forces in a high vacuum condition. This technique can process metals, alloys, and semiconductors both in liquid and solid phases over a broad temperature range. Liquid states undercooled in various degrees are produced, and their thermophysical properties are measured using novel non-contact diagnostic methods. Amorphous as well as crystalline phases may be accessed from deeply undercooled states and ensuing microstructure can be investigated, At the present time the HTESL can measure the density, the thermal expansion coefficient, the ratio of the specific heat to the hemispherical total emissivity, the surface tension, and the viscosity. Potential industrial applications of the HTESL might be in the areas of developing new amorphous metal alloys and metastable crystalline phases, determination of the thermophysical properties of semiconductors whose values are required for the modeling of crystal growth processes, and the determination of the thermophysical properties of nickel super alloys and titanium based alloys for computational modeling of casting and hearth melting processes. These capabilities will be discussed using some real examples. (If necessary, a short, 2 minutes long, video presentation may be given.)